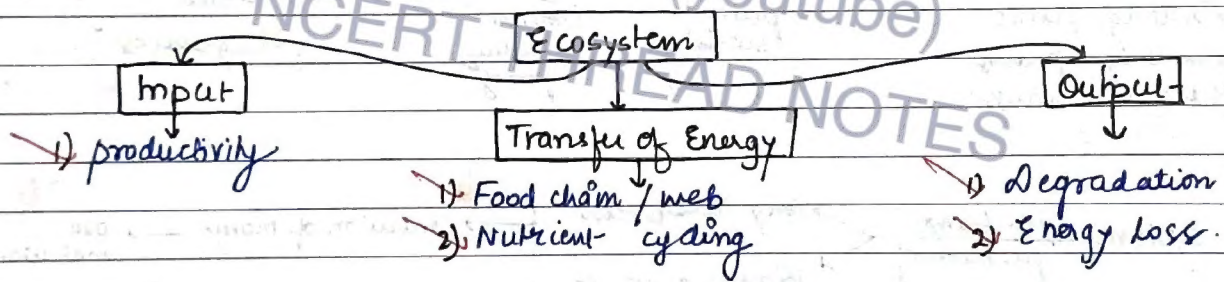
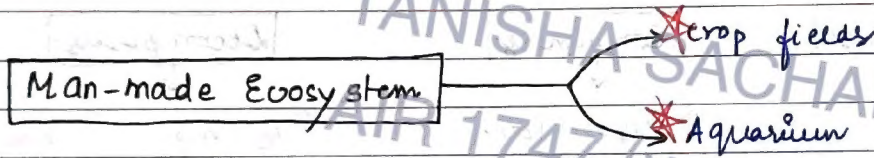
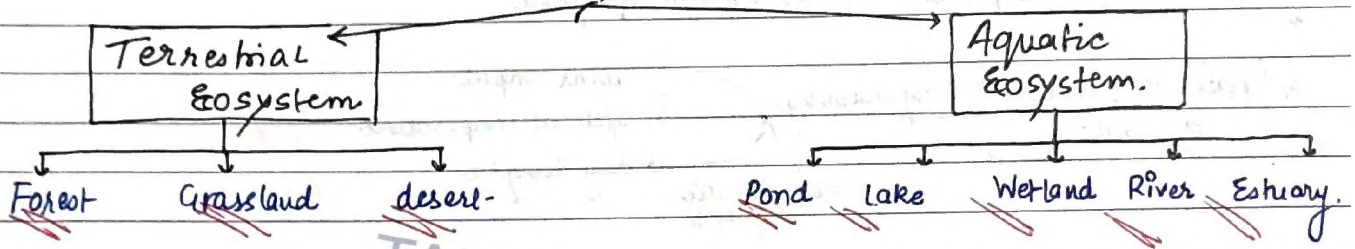


ECOSYSTEM

* Functional unit of Nature - Ecosystem organism interact amongst themselves with the surrounding physical environment.

Vary in size
From, small pond. to large forest or sea.

* Many ecologists regard (entire biosphere) as GLOBAL ECOSYSTEM.
(big too complex) → to be studied at one time, so

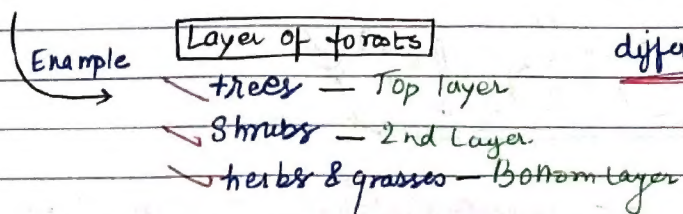


ECOSYSTEM - STRUCTURE & FUNCTION

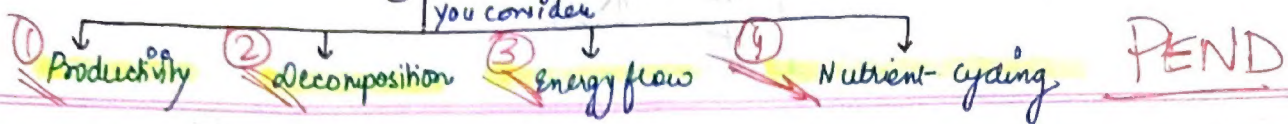
* Components → abiotic & biotic
interaction of these result in physical structure that is characteristic for Each type of ecosystem.

* Species Composition (of an ecosystem) is given by
① identification of plant species
② Enumeration of animal species

* Stratification is Vertical distribution of different species occupying different levels



* Components of Ecosystem are seen to function as a unit when



* **POND** - self sustainable unit

explains even the complex interactions that exist in aquatic ecosystems.

Shallow water body in which all above 4 components well exhibited.

Abiotic factors

1 Water → with dissolved inorganic & organic subst.

2 rich soil deposits → at bottom of pond.

* **Rate of Function of pond**

regulated by

- 1 solar input
- 2 cycle of temperature
- 3 day length
- 4 other climatic factors

* **Autotrophic components**

- 1) phytoplankton.
- 2) Some algae
- 3) Floating plants
- 4) Submerged plants
- 5) Marginal plants
→ found at edges

Consumers

1) Zooplankton
both free swimming & bottom dwelling forms

Decomposers

- 1 Fungi
 - 2 Bacteria
 - 3 Flagellates
- especially abundant on bottom of pond

* This system performs function of

any ecosystem
Biosphere as a whole

consumption of murg. → org. material
with help of Radiant energy of sun by autotrophs

1 decomposition
2 Mineralisation
consumption of autotrophy by heterotrophy

to release nutrients back for use of autotrophs
of dead matter

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AIR 1747 (youtube)

NCERT THREAD NOTES

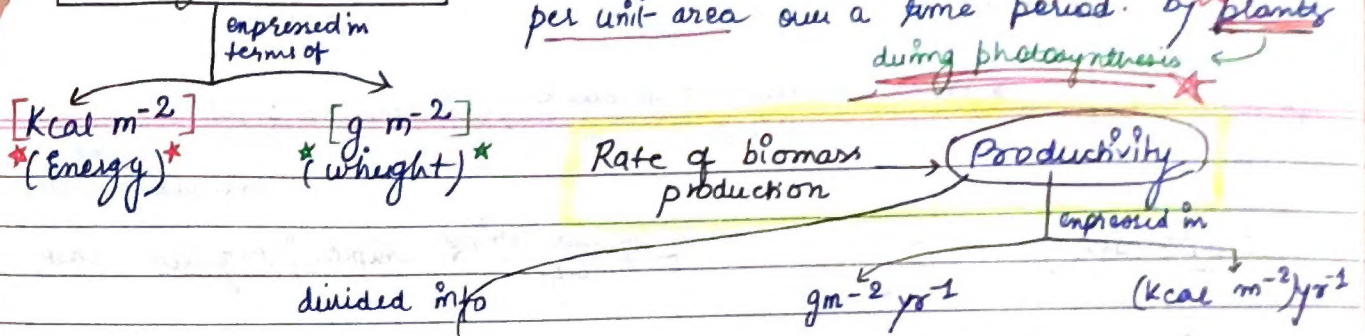
PRODUCTIVITY

* Basic requirement -
(for ecosystem to sustain function)

constant input of solar energy

There is UNIDIRECTIONAL MOVEMENT OF 'ENERGY' towards higher trophic levels & its dissipation & loss as heat to environment

* **PRIMARY PRODUCTION** → Amt of biomass / organic matter produced per unit area over a time period by plants during photosynthesis



Gross Primary Productivity (GPP)

Rate of production of organic matter during photosynthesis

(NPP) Net primary Productivity

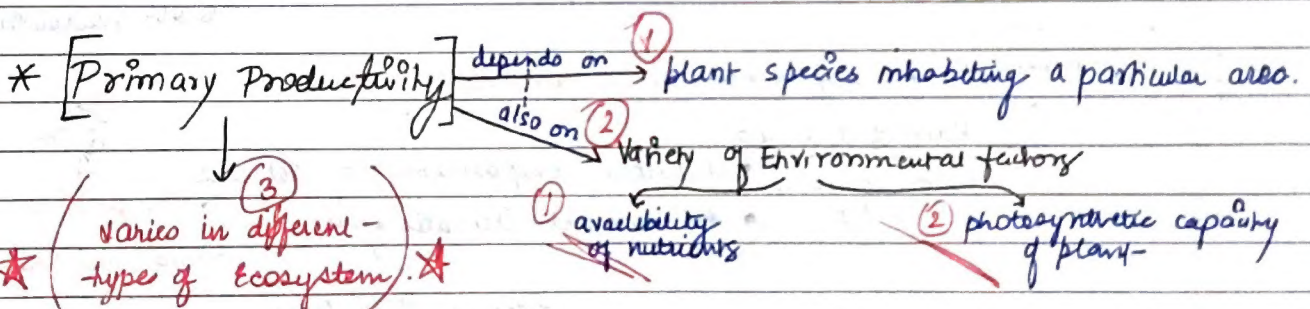
A considerable amt of GPP is utilised by plants in respiration

$$[GPP - R = NPP]$$

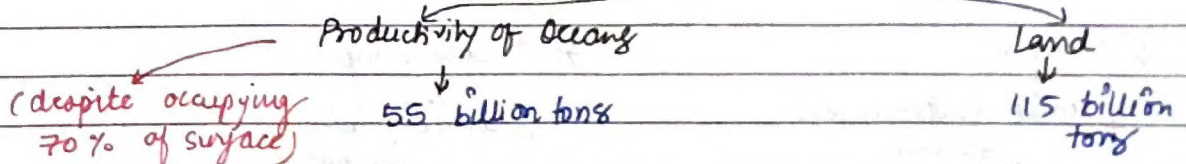
available biomass for consumption to heterotrophs

herbivore decomposer

* **SECONDARY PRODUCTIVITY** → Rate of formation of new organic matter by CONSUMERS.



* **Annual NET Primary productivity** (of WHOLE BIOSPHERE) → 170 billion tons (dry weight of organic matter)



DECOMPOSITION

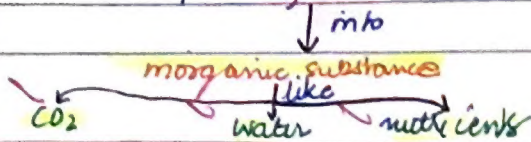
→ Earthworm - Farmer's friend

Decomposers break down complex organic matter

- ① help in breakdown of complex organic matter
- ② loosening of soil

* **Detritus** → raw material for decomposition

dead remains of plants & animals (leaves, bark, twigs, fecal matter)



Fragmentation

Breakdown detritus into smaller particles
[detritivores] → earthworm.

Leaching

Water Soluble inorganic nutrients go down into soil horizon & get precipitated as unavailable salts.

Catabolism

Bacterial enzymes & Fungal enzymes degrade detritus into simpler inorganic subst.

* All above process of decomposition occur simultaneously on detritus

During decomposition in soil occurs

- * HUMIFICATION
- * MINERALISATION

Humification

Leads to accumulation of

* dark coloured

* Amorphous subst

HUMUS → colloidal so Reservoir of nutrients

* highly resistant to microbial action

(2) Decompose at an extremely slow rate

Mineralisation

Humus degraded by microbes

releasing inorganic nutrients

soil microbes

* { DECOMPOSITION } → largely an oxygen requiring process.

Rate of decomposition controlled by

chemical composition of detritus

• environment / climatic factors

Temperature
Soil moisture

in a particular climatic condition

Decomposition Rate

slower

↓ if detritus rich in lignin & chitin

quicker

↓ if detritus rich in nitrogen & water-soluble substance like sugars

* ① Warm

② Moist Environment
↓ favours decomposition

* ① Low temp.

② anaerobiosis
↓ inhibits decomposition

* results in building up of organic materials

ENERGY FLOW

Sun → only source of energy for ALL ecosystems [Except: deep sea hydrothermal vents]

→ incident solar radiation

< 50%

PAR

(photosynthetically active radiation)

Plants capture 2-10% of PAR

this small amt of energy

We know

Plants

Photosynthetic Bacteria (autotrophs)

simple inorganic material

from Food

plants use energy to make

sustains entire living world.

* All organisms dependent on for food

Producers

either directly or indirectly

Unidirectional flow of ↓ energy from sun to producers

consumers. → then to

* Ecosystem

not exempt from

2nd Law of thermodynamics

need → constant supply of energy to synthesise → molecules they require

↑↑ disorderliness

towards

Universal tendency

to counteract

* Producers — green plants in ecosystem

Terrestrial ecosystem

- Herbaceous
 - Woody
- plants

Aquatic ecosystem

- phytoplankton
- Algae
- Higher plants

* Chain / Web of food → formed due to interdependency

* No energy trapped into a org → remains in it forever

Energy trapped (by producer) → passed on to consumer

or → organism dies

* death of org. starting of

Defines Food chain / web.

* All animals — Consumers / Heterotrophs.

Primary Consumers (feed on producers)

→ HERBIVORE

Ex. Insects
Birds
Mammals in Terrestrial Eco.
Molluscs in Aquatic Eco.

Secondary Consumers

(Eat an animal which in turn eat plants)

Primary Carnivore (eat herbivores)

Tertiary Consumers

Secondary Carnivore

(Animals which depend on primary carnivore for food)

Simple Grazing Food Chain (GFC)

Grass (Producers) → Goat (Primary consumer) → Man (Secondary consumer)

Detritus Food Chain (DFC) ^① begins with ^② dead organic matter

made up of Decomposers (Heterotrophic organisms) also known as SAPROTROPHS to decompose

[Fungi, Bacteria] mainly they meet their energy requirement by degrading dead organic matter / Detritus

* Decomposers secrete digestive enzymes → break down → simple, inorganic material

↓
absorbed by them.

dead & waste materials

★ In Aquatic ecosystem major conduit for energy flow → GFC ★

★ In Terrestrial " " → DFC ★ rather than GFC.

* DFC can be connected to GFC (at some level) → ★ Some org. of DFC are a prey to GFC animals. ★

make natural interconnections of food chain → Food Web

cycle reaches crows → In Natural Ecosystem

→ Both are OMNIVORES.

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AIR 1747 (youtube)
NCERT THREAD NOTES

★ Organisms occupy a place in natural surrounding / community → accn to their → Feeding Relationship with other organisms.

★ Organisms occupy a specific place in food chain (TROPHIC LEVEL) → based on → Source of nutrition / food.

* Amt. of energy ↓ decreases at successive trophic levels.

* When organisms die it is converted to Detritus / Dead biomass → serves as ENERGY SOURCE for decomposer.

* Organisms at each trophic level depend on those at lower trophic level → for energy demands

Standing Crop → Each trophic level has certain mass of "living material" at a particular time
 measured as ① Biomass (mass of living organism) OR ② Number in a unit-area.

* Biomass of a species expressed in ~~fresh weight~~ **Dry weight** → more accurate

* No. of Trophic levels restricted as Transfer of energy follows **10% law**

Each Trophic level from lower one **transferred** only 10% of energy to

* In NATURE → it's possible to have so many levels

- producer
- herbivore
- primary carnivore
- secondary carnivore

ECOLOGICAL PYRAMIDS

plz see Diagrams in NCERT

★ gets similar shape whether you express **① food** **② Energy relationship b/w organisms at different trophic levels**

* Relationship expressed in terms of

- Number
- Biomass
- Energy

* Base of each pyramid — producers / 1st trophic level.

* Apex represents — Tertiary / Top level consumer.

* Given organism — may occupy more than one trophic level simultaneously

* Trophic level represents Functional level
does not represent ~~Species~~

* Species may occupy more than one trophic level in some ecosystem at same time.

Eg.

SPARROW → primary consumer — eats **seeds**, **fruit**, **peas**
 → secondary consumer — eats **insects**, **worms**

* In most Ecosystems → All pyramids of Number, Energy, Biomass → **upright**

* Energy at lower trophic level → Higher level.

• producers > Herbivore
 (in both number & biomass)
 • Herbivore > Carnivore

★ Inverted pyramids \rightarrow Biomass - In sea bcz Biomass of fish \gg phytoplankton
 \rightarrow Number - Tree ecosystem

* Pyramid of Energy - Always upright \because at next trophic level some energy always lost as heat.
 Each bar in pyramids - amt of energy present at each trophic level in a given time or annually per unit area.

Certain Limitations in Ecological Pyramids

does not take into account - the same species belonging to 2 or more trophic levels

Assumes a simple food chain (something that never existed in nature) does not accommodate a food web.

Saprophytes are given any place in ecological pyramids even though they play vital role in ecosystem

ECOLOGICAL SUCCESSION

Important characteristic of Community \rightarrow their structure & composition changes constantly in response to changing environmental conditions.

★ This change is ① orderly & ② sequential

③ parallel with the changes in physical environment

These changes lead finally to Community - that is near equilibrium with environment
 CLIMAX COMMUNITY

* Gradual & Fairly predictable change in the species composition of a given area
 ECOLOGICAL SUCCESSION \leftarrow is called

* During succession \rightarrow some species colonise an area & their population increases whereas others become numerous & some decline & even disappear

* Entire sequence of communities that successively change in a given area.
 SERE (s)

* Individual transitional communities \rightarrow termed as SERAL STAGES / SERAL COMMUNITIES

- * In successive seral stages } there is
 a
 * change in diversity of species of organism
 * increase in no. of species & organisms
 * increase in Total biomass

* Present day communities (in world) is
 bcz of succession that occurred over millions of years
 life started on earth since

* Succession
 * Evolution } parallel process at that time

* Succession → starts in an area where no living organisms are there.

Primary Succession

* NO living org. ever existed

Eg → Bare rock

→ Newly cooled lava

→ Newly created pond/Reservoir

* Establishment of new biotic community
 is GENERALLY SLOW.

Soil ← before this is established there should be

* Depending mostly on climate
 ↓ it takes natural process

100 - 100's yrs to produce FERTILE SOIL on Bare Rock.

Secondary succession

* Area that somehow lost all the org. that existed there.

Eg - Abandoned farm lands

Burned forests

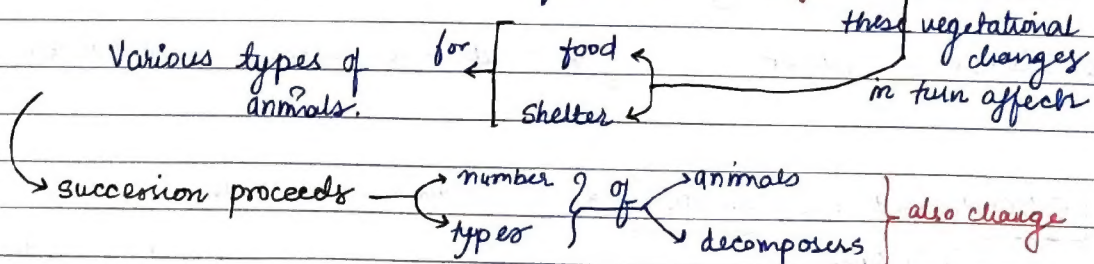
Cut forest

Lands have been flooded.

* In areas, where natural biotic communities have been destroyed.

* Since some ^① soil / ^② sediment present
 ↓
faster than primary succession

* Description of ecological succession usually focuses on change in vegetation.



* At any time during primary / secondary succession { Natural disturbance Human induced disturbance (fire, deforestation) }

* Such disturbances create new conditions that

encourage some species

discourage / eliminate other species

Earlier Stage

in Particular

Seral Stage of succession

can convert

Succession of Plants

Based on Nature of Habitat

In wet areas →

(hydric → mesic)
Hydrarch ~~Succ~~ Succession

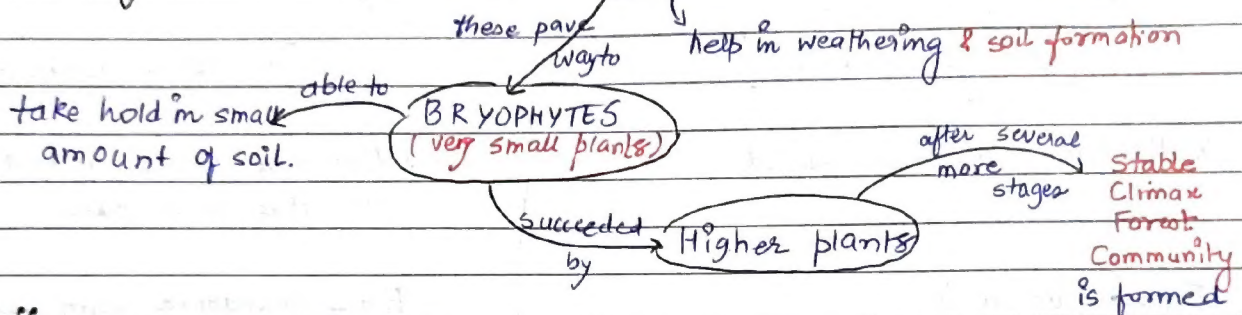
In dry areas →

Xerarch succession
(xeric → mesic)

Mesic - medium water condition
neither too dry, nor too wet

* Species invading bare area - Pioneer species

* Primary succession on rocks - **Lichens** → secrete acid to dissolve rocks.



"Climax community remains stable as long as environment remains unchanged."

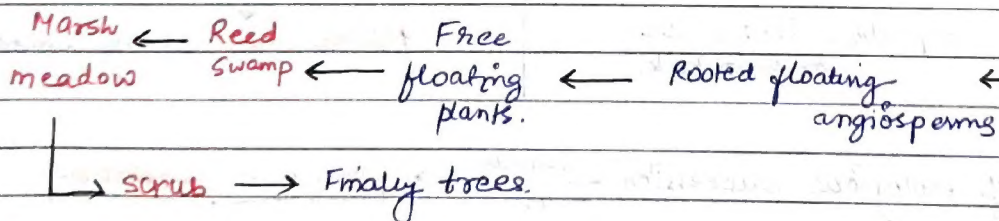
* With time, xerophytic habitat gets converted into mesophytic one.

PRIMARY SUCCESSION IN WATER

Pioneers - small phytoplanktons

↓ replaced by

Rooted submerged plants.



~~9/9~~ Climax - Forest

~~9/9~~ With time water body converted into land.

SECONDARY SUCCESSION

→ species that invade depends on

↓ Soil is here → rate of succession much faster

↓
hence climax reached more quickly.

- condition of the soil
- availability of water
- environment
- seeds/propagules present.

- * Primary succession → very slow process.
 → takes thousands of years for climax to be reached.

- * All succession whether taking place on → Land → proceeds to similar climax community
 → Water

living org. rocks, air, water
 (BIOGEOCHEMICAL CYCLES)
NUTRIENT CYCLING → storage movement of nutrient elements through various components of ecosystem.
 MESIC.

Organisms need constant supply of nutrients to → grow
 → reproduce
 → regulate various body function

STANDING STATE — The amount of nutrients (C, N, P, Ca etc...) present in soil at a given time.

varies in
 → different kinds of ecosystem
 → on seasonal basis

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NCERT THREAD NOTES

- * Nutrients never lost from ecosystem → recycled time & again indefinitely.

Gaseous cycle

Nitrogen, Carbon

Reservoir - atmosphere

Sedimentary cycle

Sulphur, Phosphorus

Reservoir - ~~sedimentary~~ Earth's crust

Function of Reservoir - to meet with deficit which occurs due to imbalance in rate of influx & efflux.

Teacher's Signature.....

Environmental factors

- Soil
- Moisture
- pH
- Temperature

} regulate the rate of release of nutrients into the atmosphere.

ECOSYSTEM - Carbon Cycle

occurs through

- atmosphere
- Ocean
- Living & dead org.

'C' constitutes 49% of dry weight - of organisms
↳ next to water

Reservoir that regulates amount of C in atmosphere

Total Global Carbon

- 71% 'C' - dissolved in OCEANS
- 1% 'C' - in atmosphere.

Fossil fuels - also Reservoir of Carbon.

★ 4×10^{13} kg carbon is fixed annually in biosphere through photosynthesis

★ Considerable amount of carbon returns to atmosphere as CO_2 through - respiratory activities of producers & consumers.

★ Decomposers - contribute substantially to CO_2 pool by processing of - waste materials & dead organic matter of land or oceans.

★ Some amount of fixed carbon is LOST TO SEDIMENTS & removed from circulation.

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NCERT THREAD NOTES

Additional sources for releasing CO_2 in the atmosphere

- Burning of Wood
↳ Forest fires
- Combustion of Organic matter
↳ Fossil fuels
- Volcanic activity

Human Activities have significantly influenced Carbon cycle.

- Rapid Deforestation
- Massive burning of fossil fuel (for energy Transport)

} ↑↑ rate of release of CO_2 into atmosphere.

ECOSYSTEM - Phosphorus Cycle

major constituents of
 → Biological membranes
 → Nucleic acid
 → Cellular energy Transfer system

↓
 Many animals need it
 (large quantities) of 'P' to
 make shells
 Bones
 Teeth

★ Natural Reservoir of P - Rock (contains 'P' as phosphates)

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When weathered minute quantity
 of phosphate dissolve in soil
 solution & ^{is} absorbed by the roots

NCERT THREAD NOTES

★ Herbivore & other animals get 'P' from → Plants

★ Waste products
 Dead organisms] decomposed by → phosphate-solubilising bacteria
 releasing PHOSPHORUS.

★ Unlike 'C' cycle, no respiratory release of 'P' in atmosphere.

⊗ 2 Differences b/w Carbon & Phosphorus Cycle:

1) Atmospheric inputs of phosphorus through rainfall is <<< than Carbon inputs.

2) Gaseous exchanges of phosphorus b/w organisms & environment are negligible.

Teacher's Signature.....

ECOSYSTEM SERVICES

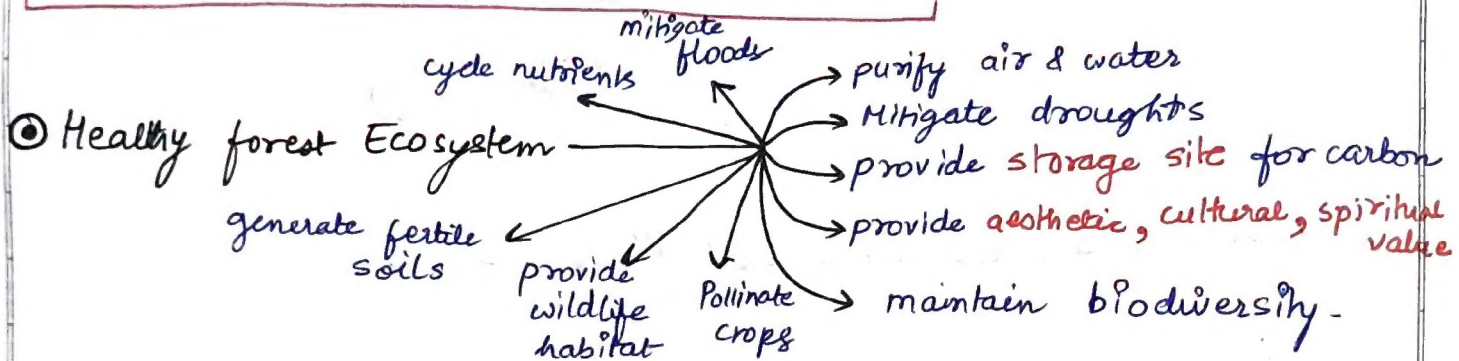
Healthy ecosystem

base
for

wide range of economic
environmental
Aesthetic

goods &
services

Products of ecosystem process] named as Ecosystem Services



Value of such services difficult to determine

→ Biodiversity should carry a hefty price tag

* ROBERT CONSTANZA & his colleagues → very recently tried to put price tags on Nature's life supporting services

* Researchers have put Avg. price tag of US \$ 33 trillion / a year on fundamental ecosystem services.

nearly twice the value of the global GNP (gross national product) → US \$ 18 trillion.

but are taken for granted bcz they have free.

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NCERT THREAD NOTES

★ Out of the total cost of various ecosystem services :

1) Soil formation accounts for 50 %.

2) Recreation
Nutrient Cycling } → are less than 10% each

3) Climate Regulation
Habitat for Wildlife } → about 6% each

New

→ Few Points from SUMMARY :

1) Atmosphere Or Hydrosphere is reservoir for gaseous type of cycle (Carbon)

★ 2) Biotic community — Dynamic
undergoes (changes) with the passage of time

↓
are sequentially ordered
↓ constitute
ecological succession